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2000

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### Recommended Citation

Romm, C. and Taylor, W., "Community Informatics: The Action, Reaction, Integration (ARI) Model" (2000). *AMCIS 2000 Proceedings*. 120.

<http://aisel.aisnet.org/amcis2000/120>

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# Community Informatics: The Action, Reaction, Integration (ARI) Model

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Category: Organisation. Key words: Community, informatics, diffusion, case-study, Australia

## Abstract

The purpose of this paper is to analyze the emerging literature on community informatics with a view to developing a strategic framework, described as the Action, Reaction, Integration (ARI) model. We start by presenting the major themes in the research on community informatics. The review is intended to highlight issues that have attracted most research efforts on Community Informatics. We conclude by asserting that issues related to the strategy of community informatics have not received enough attention. Hence, the need for a theoretical models that focus on this area. We proceed to present the ARI model, with examples from a real life case study that took place in Rockhampton, Australia. We conclude with an outline of the major directions for future research emanating from the ARI model.

## Introduction

The term "community informatics"(CI) is defined in this paper as a technology strategy or discipline that focuses on the use of Information Technology (IT) by territorial communities. As indicated by Gurstein (1999), CI links economic and social development at the community level with emerging opportunities in such areas as electronic commerce, community and civic networks and tele-centers, electronic democracy, self-help, advocacy, and cultural enhancement. As such, this term brings together the concepts of IT and information systems with the concept of community development.

As an area of research, CI can be regarded as the body of theory underlying one of the most exciting phenomena of the last decade, namely the diffusion and use of Internet technologies within communities (Eger, 1997; Canadian Government, 1998; and Nordicity, 1997). The diffusion of Internet technologies in communities is a reality not just in North America and Europe, but also in Asia, Australia, and the Middle East. There are also large-scale CI projects in South America and Africa.

## Literature Review

A review of the literature on CI reveals that it focuses on the following themes:

### *1. Why Is It Important For Communities To Learn To Use IT?*

The answer provided by the literature is that communities are now part of the global village and no longer exist in isolation within 'nation states'. The pressures of globalisation mean that communities need to learn to benefit from this new economic and social reality, or they will be left behind. It is suggested in the literature that the only way that communities, particularly in regional and rural areas can survive in this new world order is for them to use IT for linking with the global village (Canadian Government, 1998; Lankester, 1998; and Giddens, 1999).

It is important to note that not all the literature in this area is in agreement that it is important or even beneficial for communities to learn to use IT for communication among their members. As indicated by Kling (1996), in a paper that focuses on the use of Internet technologies by communities in California, the ways that people work and communicate via computer networks could potentially "destabilize conventional social categories".

### *2. How Can IT Support Community Development?*

It is suggested in the literature that IT can support community development through helping communities identify and harness local commitment, resources and skills (Canadian Government, 1998; Eger, 1997; Pigg, 1998; AFCN, 1999). The assumption is that once community efforts are put together, the resulting joint effort would lead to stimulation of sustainable local economic activity and improvement of quality of life (Aspen Institute, 1996). This assertion is based on the premise that communities have considerable untapped capacity and that IT can help them become aware of this capacity and bring it to fruition.

### ***3. What Makes CI Effective In Some Communities?***

One of the most important themes in the literature on CI is the search for effective means for diffusing IT within communities. In this context several success stories are frequently quoted. The first of these, the Missouri Express Project, was established in Missouri in 1993. This project aimed to connect 80 communities in Community Information Networks (CIN's) over a three-year period (Pigg, 1998). The emergence of the Smart Communities concepts in San Deigo in 1994, led to the establishment of the World Foundation of Smart Communities in 1997 (Eger, 1997). The approach underlying these projects was based on a wide variety of IT applications intended to create vibrant sustainable regional economies through targeting business and formal educational processes.

One of the early attempts to identify issues that can help remote communities benefit from CI was initiated by Gurstein (1999). In his discussion of the CI Project at Cape Britton, Nova Scotia, which he initiated and led, Gurstein mentioned the following as potential advantages of CI for remote communities: (1) overcoming the tyranny of distance; (2) achieving local ownership and management of local information (3) making tele-work possible; (4) enabling local nuance in the processing of information; (5) promotion of flexibility for small scale distributed production; and (6) obtaining economies of dis-aggregation.

### ***4. What Factors Can Interfere In The Successful Diffusion Of IT Within Communities?***

Gurstein's work (1999) also heralded the beginning of the search for factors that may hinder the successful diffusion of IT within communities. Based on his findings, Gurstein indicated that less than successful CI projects were associated with the failure to link the projects with local economic activity and to unite community efforts behind strong leadership. In this context, Gurstein (1999) saw the use of CI as a double-edged sword. Whilst it could facilitate community development, it could also be associated with discord within the community resulting from the differential effect on various community stakeholders.

angfenp1033 A recent paper by Kling (1999) alerted researchers to the need to develop theoretical tools that would assist in understanding and eventually overcoming obstacles to diffusion of IT within communities. In response to this call, another recent paper (Romm and Taylor, 2000) outlined a model of diffusion of IT within a CI context. The model builds on the

literature on diffusion of IT in organizations, highlighting the unique issues that need to be addressed when diffusing IT in communities as opposed to work organizations. Building on previous work by Markus 1994 and Romm, Pliskin, and Clarke, 1997, Romm and Taylor (2000) mentioned technology, motivation, task, structure environment, politics, and culture as critical to successful diffusion of IT within a CI context.

### ***Toward A Strategic Model Of CI***

The ARI model was developed in the context of the following **six** constraints:

1. CI projects may start from a very low base line, namely, a community whose diffusion of IT is minimal.
2. There are exogenous and endogenous variables that motivate the community to embark on a CI project.
3. Certain steps have to be undertaken to close the gap between the relatively low base line at the beginning of the project and the desired high level of IT diffusion at its end.
4. No assumptions are made about the **nature** or **source** of the resources that are available to the community to support the CI project.
5. The model does not focus on the actual diffusion process, or on variables that could assist or hinder such a process. Instead, it focuses on the strategic decision making of the project leaders.
6. The model is prescriptive rather than descriptive. Its emphasis is on recommending a course of action that is **analytically** sound rather than explaining a set of data.

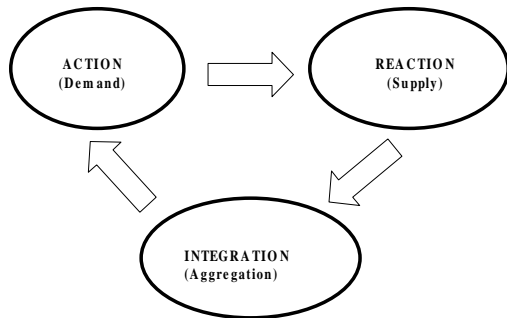
### ***The Assumptions Underlying The ARI Model***

The ARI model is based on the following assumptions:

1. The model is based on three building blocks, Action, Reaction, Integration (see Figure 1).
2. The Action (A) component is defined as activities (or projects) intended to increase demand for IT products and services. The Reaction (R) component is defined as activities intended to increase supply of IT products and services. The Integration (I) component is defined as activities intended to integrate the demand for and supply of IT products and services through aggregation of either demand or supply or both.
3. The goal of a CI project is to establish higher levels of demand and supply for IT products and services within communities.
4. In order to reach higher levels of demand and supply for IT products and services, projects that are intended to increase both demand and supply should be undertaken.
5. Ultimately, the goal of CI projects should be to aggregate demand and supply for IT goods and services,

as their aggregation will result in an upward spiral of increase in both demand and supply, establishing a self sustaining “market” for IT products and services.

Figure 1. The Components of the ARI Model



6. Of the two variables (supply and demand), demand is easier to manipulate by external agents. Therefore, for the purpose of the ARI model, it is defined as the “Action” phase and describes the set of intervention activities that should take place **first**.

7. The ARI model refers to the manipulation of supply for IT products and services as the “Reaction” phase based on the assumption that it would be more difficult to manipulate it in a community context unless a demand for IT products and services **already exists**. In other words, it would be difficult to convince industry to provide a community with Internet based products and services (particularly a remote community or one placed in a developing country), unless there is already a body of customers willing to buy the products and services.

8. The ARI model refers to the aggregation of demand and/or supply of IT products and services as “Integration” phase because this set of activities represents a level of integration involving the first two. The model also assumes that aggregation will not be possible to achieve unless a minimum level of both demand and supply for IT goods and services have been established.

9. The ARI model assumes that the three components, “Action”, “Reaction”, “Integration” (or demand, supply, aggregation) will drive each other, ultimately producing a mutually dependent upward spiral effect where all three continue to increase over time.

10. Finally, the ARI model assumes that to sustain a CI project over time, the leaders of the project will have to maintain a “balanced portfolio” of “Action”, “Reaction” and “Integration” activities, intended to reinforce each other.

## The Rockhampton Case Study

In the following sections, a short version of the Rockhampton case study is presented. For a full version of the case study, please contact the authors.

Rockhampton is the capital of Central Queensland, Australia, a region that is five times the size of the UK.

The city, which has a population of about 60,000 people, is the commercial centre for a rural population of about 250,000.

The CI project at Rockhampton was initiated by the University in early 1998. Over the next two years, the Provost leading the project was successful in leasing, purchasing and receiving as donations a number of heritage buildings in the town’s CBD which were to be used as the basis for the project. The President made it clear in a series of lectures to the university community that the CI project was not about moving the university into a city campus. Instead, it was going to be a total change in the role of the university in the community, being based on outreach activities with the community, with a strong emphasis on community informatics.

### *Phase 1 of Community Informatics projects*

#### *1. Projects intended to promote demand for IT products and services*

During 1998 and early 1999, two projects that were intended to promote awareness of Internet technologies were initiated. These included: “The Rural Youth project”, which provided public access points for youth in a dozen of Central Queensland’s small rural communities, and the “Indigenous Networks project”, intended to promote awareness and provide public access to the Internet to 15 aboriginal communities in Central Queensland.

#### *2. Projects intended to promote supply of IT products and services*

During 1988 and early 1999, several developments that signaled an increase in the supply of Internet products and services took place. These included a marked increase in the number of ISP’s in the city (from two to seven), and a significant increase in the number of Web design companies. Another important development was the establishment of an Internet Café by one of the largest ISP’s and an aggressive campaign by the local banks for residents to take advantage of the banks’ newly developed Internet Banking packages.

#### *3. Projects intended to promote aggregation of demand and supply*

The most important project representing aggregation of demand and supply at this period was launched in late 1999 by the largest ISP in the city. The project was a community portal, supported by an extensive database of businesses in the city and accompanied by an on-line news bulletin with information about the city’s major attractions and events. The portal was developed on a very low budget and had a very low “hit rate” but was still an important attempt to create a platform where Internet based businesses and customers could interact as one market.

## Phase 2 of community informatics projects

### 1. Projects intended to promote demand for IT products and services

By the end of 1999, the university initiated the first Internet awareness project within the city. The project, entitled “COIN” (for community informatics) established an “evolving” web site for one of the suburbs. The objective of the project was for the community to eventually use the web site as a basis for a number of lists and chat-groups. The project was also intended to facilitate training activities for the members of the community on Internet related areas. Another project, also conceived in late 1999 was ‘SeniorConnect’. This project was supported by the City Council and was intended to introduce senior citizens in the city to Internet technology.

### 2. Projects intended to promote supply of IT products and services

During late 1999 and early 2000, several developments that signaled further increase in the supply of Internet based products and services took place. The first was an announcement by the City Council that it would establish a number of “Kiosks” around the city shopping centers where a range of services (paying of fees, obtaining licenses etc.) can be accessed on-line. At about the same time, several companies dedicated to Internet training moved into the city, establishing alliances with some of the major ISP’s and computer retailers. These companies offered a range of training courses, particularly on how to use the new services (telebanking, the city council’s kiosks) and how to engage in Electronic Commerce. In response to a growing demand from the community, the University announced the launch of the Smart City Telecenter, a public access point in the CBD (with e-mail and videoconferencing facilities) intended to support commercial and individual teleworkers.

### 3. Projects intended to promote aggregation of demand and supply

By late 1999 the second major project representing aggregation of demand and supply, an application for an IT Incubator, was initiated by the city. To maximise the city’s chances to win the bid, the City Council established an Incubator Planning Board with representation from all major employers and citizen groups in the city. In the proposal, it was made clear that the Incubator would rely on software development projects provided by the major industry players (aggregation of demand for IT products and services) while at the same time, approach one of Australia’s largest computer retailer and software development companies as a potential employer of IT teleworkers from the city (aggregation of supply of products and services). In this sense the project represented an attempt to aggregate both demand and supply. Table 1 below categorizes the CI projects

undertaken in terms of the major components of the ARI model.

Table 1. Project Categorization

	Action	Reaction	Integration
Phase 1	Rural Youth	g1036ISP’s	Portal
	Indigenous Communities	Web designers Internet Banking	
Phase 2	COIN Senior Connect	Kiosks Internet Training Telecenter	Incubator

## Discussion And Conclusions

One of the most important issues raised by the ARI model is the question of timing of intervention activities. The model suggests that even though activities that promote demand and supply for IT goods and services should be undertaken **simultaneously**, demand related activities should take precedence.

Does this mean that unless a minimum level of demand has been reached no activities that involve manipulation of supply or aggregation of both supply and demand should take place?

The answer to this question is no. The fact that a community is at a low level of diffusion and most efforts are focused on increasing demand for IT products and services, does not mean that activities that are intended to increase supply **should not** be undertaken. Similarly, even though a minimum level of both demand and supply is probably necessary for aggregation to occur, it is possible, as the case study demonstrates, to envisage low level (the community portal project), as well as, higher level (the Incubator) of aggregation of supply and demand.

Even though demand-driving activities should precede any other activities, an **overlap** between demand and supply driving activities is desirable. Similarly, even though a minimal level of demand and supply is probably necessary for any useful aggregation to take place, an **overlap** between supply and aggregation driving activities is possible and perhaps desirable, as aggregation of demand or supply is likely to increase both.

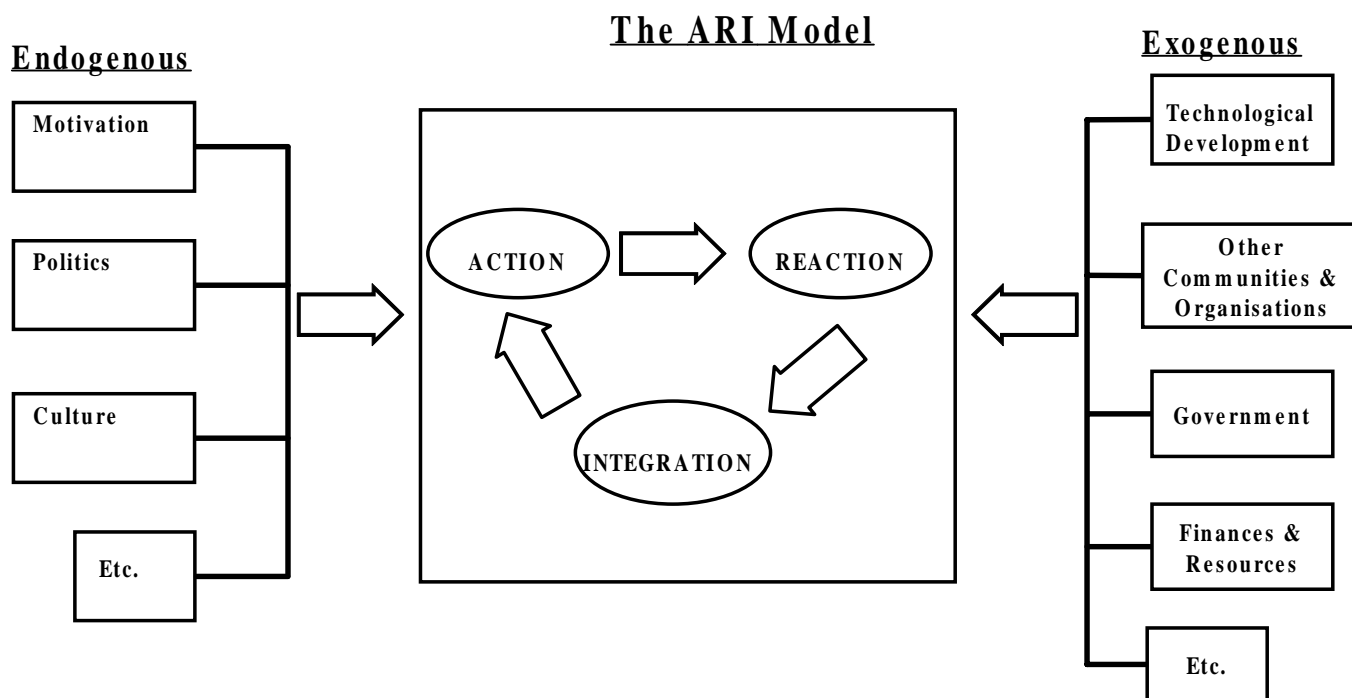
Another interesting implication from the ARI model, relates to the relationship between the model and other

exogenous and endogenous variables. Obviously, there are quite a few variables that may impact on the levels of demand and supply for IT products and services within communities, irrespective of the decision making processes undertaken by the project leaders. Figure 2 below outlines some of the variables that should be considered by future researchers exploring CI strategy in a broader context.

As indicated in Figure 2, the success prospects of a CI project is likely to be affected by two sets of variables: exogenous variables that relate to the environment external to the community and endogenous variables that relate to the community itself.

- How do the relationships between the variables in the model change over time? And,
- Do the variables apply equally in different political systems (e.g. communist versus capitalist), national cultures, or sizes of communities?

Figure 2 – Exogenous and Endogenous Variables Impacting on the ARI Model



Both exogenous and endogenous variables will affect not only the overall outcome of the project but the degree to which the leaders will enjoy the support and trust of the community while the project is in progress.

The model raises a number of other empirical issues that deserve further investigation, including: What is the specific nature of the relationship between the endogenous and exogenous variables and how do they interact with the basic components of the ARI model, for example, are high levels of some variables (e.g., political disharmony within the community) associated with significantly lower levels of demand for IT products and services?

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